

COAL NONFATAL

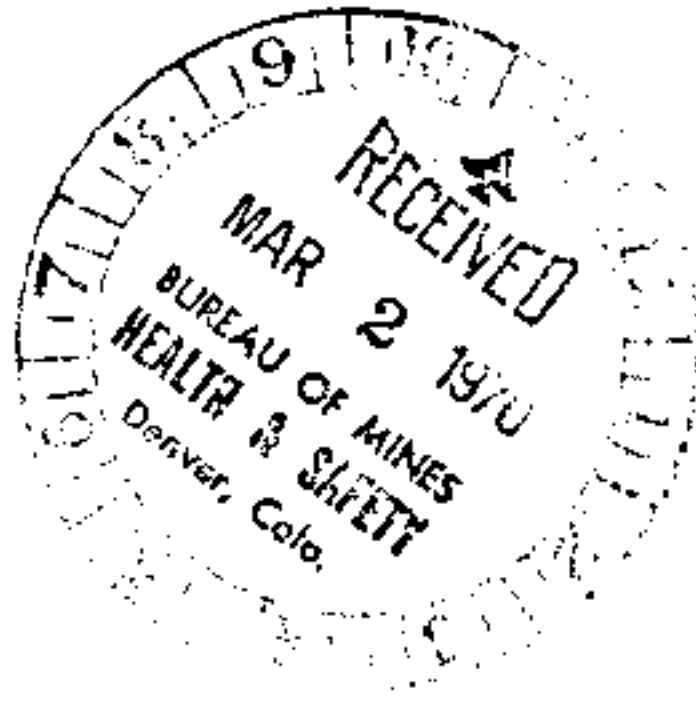
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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

DISTRICT C



REPORT OF COAL-MINE BUMP ACCIDENT
MOSS NO. 2 MINE
CLINCHFIELD COAL COMPANY
CLINCHFIELD (P.O. DANTE), RUSSELL COUNTY, VIRGINIA

January 8, 1970

by

J. L. Gilley

and

W. R. Compton
Mining Engineers

Originating Office - Bureau of Mines
Norton, Virginia 24273
J. S. Malesky, District Manager
Coal Mine Safety District C

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INTRODUCTION

This report is based on an investigation made in accordance with the provisions of the Federal Coal Mine Safety Act (66 Stat. 692; 30 U.S.C. Secs. 451-483) as amended.

A bump occurred in the tail entry chain pillars of the No. 2 longwall panel between 5 and 6 lefts off 3 North in the Moss No. 2 Mine about 8:50 a.m., Thursday, January 8, 1970. William B. Powers, section foreman, who received minor injury to the back and right side, when he was knocked down by the resultant shock wave, was hospitalized two days for examination and treatment. There were no other injuries or property damage.

The Norton office of the Bureau of Mines was notified of the occurrence about 10:00 a.m., January 8, 1970, by J. W. Fleming, Manager Safety Division, and an investigation was started the same day and was completed January 9, 1970.

Information for this report was obtained from statements of company officials and employees and from an investigation at the scene of the occurrence, which had been disturbed to the extent that the longwall face had been retreated about six feet.

GENERAL INFORMATION

The Moss No. 2 Mine at Clinchfield, Virginia, on State Route 621, is entered through one slope and three shafts into the Tiller coalbed, which varies from 30 to 66 inches in thickness in current mining areas. Total

employment was 416 men, 366 of whom worked underground on a triple-shift basis, 5 days a week, to produce a daily average of 5,446 tons of coal. The coal was loaded with conventional loading machines, continuous mining machines, and one Long-Airdox longwall shearing machine. Coal was transported by shuttle cars, belts and electric locomotive haulage systems.

The mine was developed by a multiple-entry system, and final mining consisted of room-and-pillar and longwall methods. Pillar extraction was primarily by a split-and-fender method. Longwall mining was accomplished with a unidirectional shearer equipped with a 48-inch diameter, 27 inches wide, shearing drum, that sheared a 24-inch wide cut as it moved across the face. The coal height on the current longwall panel ranged from 52 to 60 inches.

Roof support in development entries for the longwall panels consisted of roof bolts, 5/8-inch in diameter, 48 inches in length, installed on 4-foot centers in accordance with plans approved by a Bureau of Mines roof-control representative. Roof support for the longwall face was provided with 76 hydraulic-powered, self-advancing jacks of 70-ton capacity, 4 to a support unit, with articulated canopy. Average spacing of the units was 43 inches; normal increment of advance of the support units was about 24 inches, which left a prop-free face distance before a cut of approximately 50 inches. Single unit hydraulic props and timbers were used for temporary support in the vicinity of the head drive unit; hydraulic props only were being used at the tail section for temporary support.

The topography overlying the left side of 3 North was rugged, and some of the mountains attained 2,960 feet in elevation and exceeded 1,400 feet in relief. The cover in the 6 left 3 North area ranged from about 1,350 to a maximum of 1,450 feet.

The natural conditions in the areas projected for longwalling on the left side of 3 North, including the 6 left longwall, were favorable for outbursts or bumps. Information from logs of 4 boreholes near this area indicated that the main, secondary, and immediate roof structure was predominately sandstone that ranged up to 51 feet in thickness to the overlying Jawbone coalbed. (See Figure 3.) The immediate floor was a hard, dense sandy shale and sandstone that resisted heaving. The coal is structurally strong but brittle and shatters readily from a blow or stress. Face-and-butt cleavage planes of the coal are discernible but were not pronounced in the 6 left 3 North area.

The first longwall mining was started in 5 left adjacent to a mined-out area that comprised 2 panels, approximately 1,590 feet long and 550 feet in width; mining in these panels was by the room-and-pillar method with

continuous miners. The 5 left longwall, designated in this report as No. 1 panel, was 200 feet in width and 1,740 feet in length, and was completed October 11, 1969. Two rows of chain pillars, approximately 55 by 55 feet in dimension, intervened between the old gob area and the No. 1 panel. The No. 2 longwall panel, 275 feet in width and 1,950 feet in length, was started October 20, 1969. Two rows of chain pillars developed by entries and crosscuts, 20 feet in width and projected on 75-foot centers, intervened between the No. 1 panel gob area and the current No. 2 longwall panel for protection of the tail entry. At the time the bump occurred, the No. 2 panel had retreated 1,350 feet.

From Figure 2, it will be noted that total mining in the area, at the time, comprised adjacent panels of varying widths and lengths. It was postulated that the subsequent caving that had occurred up to the time of the bump, terminated at different horizons in the respective panel gob areas; this caving possibly was limited to the immediate and secondary strata in some areas of the goaves. This restrictive caving probably resulted in the establishment of comparatively flat arches acting as flat beams or plates across the chain pillars intervening between the contingent goaves of the mined-out panels and the current longwall. From Figure 2, it will be noted that chain pillars between Nos. 1 and 2 panels were situated in zones of superimposed abutment pressures within the maximum pressure arch. Loads on the pillars affected, increased progressively by build-up of pressures from the incremented dimensional increase of the void area. Reportedly, difficulty had been experienced from intermittent fracturing of the roof in the front prop-free space of the longwall for several weeks prior to the bump; however, during the investigation, no unusual stressed conditions, except localized floor upheavals in the Nos. 1 and 2 tail entries, were evident outby the longwall face.

The investigating committee consisted of the following:

CLINCHFIELD COAL COMPANY

Henry Kiser
Delmar Broyles
Calvin Phillips

Superintendent
Assistant General Mine Foreman
Mine Inspector

UNITED MINE WORKERS OF AMERICA, LOCAL UNION NO. 1093

Dewey Cain

Mine Committeeman

UNITED STATES BUREAU OF MINES

J. I. Gilley
W. R. Stewart
W. R. Compton

Mining Engineer
Coal Mine Inspection Supervisor
Mining Engineer

The last Federal inspection of the mine was completed on November 24, 1969.

DESCRIPTION OF OCCURRENCE

It is normal procedure to perform maintenance on the longwall equipment on the 12:00 midnight to 8:00 a.m. shift. Two repairmen and two "move-up" men assigned to the January 8, 1970, shift completed their maintenance assignments about 5:00 a.m. and started longwall operations. Members of this crew stated that the area had been relatively quiet, but near the end of the shift processes leading to stress-relief, such as noises, accompanied by localized disruptions of coal for a distance of about 60 feet next to the tail end of the longwall, occurred intermittently during shearing operations.

On the day of the bump, the 6 left longwall crew, consisting of eight workmen and William Powers, the section foreman, left the surface at 8:00 a.m., and arrived on the section at 8:45 a.m. Meanwhile, the men on the 12:00 midnight to 8:00 a.m. shift had left the section.

When the day-shift crew arrived at the entrance to the 6 left section, they heard a loud noise from the direction of the longwall area. Some members of the crew thought a bump occurred but others thought the noise was caused by a large roof fall. After arriving on the section, Powers assigned specific duties to members of the crew and then proceeded across the longwall face, making an examination toward the tail section. Reportedly, conditions appeared normal during his examination and no evidence of a bump was found. Delmon Owens, tail-unit operator, followed Powers across the face. They arrived at the tail section, and as they started to measure the face location, the bump occurred. Powers was knocked down by the concussion but recovered and traveled down the return airways to the 3 North mains, thence up 6 left to the longwall head unit. Owens traveled the same route and arrived at the head unit several minutes later. In the meantime, all members of the crew had been accounted for. The dispatcher was notified of the occurrence and he in turn notified the general mine foreman and mine superintendent. Within a short time the general mine foreman and assistant mine foreman arrived on the section and took charge. The mine superintendent arrived on the section soon afterwards. Normal ventilation was re-established, and after thorough examinations of the longwall face and surrounding areas, and inasmuch as there were no apparent further reactions from the bump, production of coal was resumed.

Members of the day-shift crew stated that a short time after the section foreman and Owens traveled across the face, they started to their assigned stations; and soon thereafter, they perceived reactions taking place in the roof, extending from the longwall face to the overhang, thence, into the goaf, reflected by load conditions such as yielding of the hydraulic

props along the face, fracturing of the roof in the goaf and stress-relief noises emanating from the strata. Reportedly, within about a minute after these manifestations the bump occurred.

Six of the tail-entry chain pillars adjacent to and slightly inby the conveyor tail-drive unit were affected. Coal was expelled violently from 2 of the pillars; the entry between them was completely filled with pulverized coal, leaving voids, 6 to 10 inches in height that extended several feet into these pillars. The other 4 pillars were affected to lesser degrees. Pronounced floor heave occurred in the entry between these 6 pillars and to some extent at two locations in the tail entry outby the longwall face.

Reportedly, the roof inby and outby the longwall stressed for several minutes following the bump. Dense clouds of dust were thrown into suspension. Two temporary stoppings in the 2 entries on the head-drive side of the longwall were dislodged, but they were repaired and normal ventilation was restored as soon as possible. A workman, who was near the cut-out switches, cut off the electric power soon after the bump occurred.

Inspection of the company's overlay maps incorporating the area involved in the bump in the Tiller coalbed and the corresponding areas in the superjacent Upper Banner and the Lower Banner coalbeds, revealed that the 6 left longwall had recently retreated out from under a group of unmined pillars in the Upper Banner coalbed. Figure 2 indicates the relative positions of the 6 left longwall face in the lower bed and the unmined pillars in the overlying bed at the time the bump occurred.

The interval between the group of unmined pillars in the Upper Banner coalbed and the area involved in the bump in the Tiller coalbed, was 850 feet. From Figure 2, it will be further noted that the general arrangements of these isolated unmined pillars formed an island abutment and that the pillars showed considerable variations in shape and size. Elevation of the 6 left longwall area was 1,425 feet; elevation of the area of the isolated coal pillars in the Upper Banner coalbed was 2,273 feet and the elevation of the surface over these areas was 2,330 feet.

It is realized that an interval of 850 feet comprising several stratum of sandstone ranging from 31 to 70 feet in thickness should be sufficiently competent to negate effect of pressures extending from the unmined pillars in the overlying coalbed to the workings in the subjacent bed. But it is possible, in combination with other basic environmental factors, the additive effect of the pressures induced by two superimposed pressure arch abutment zones, that of the normal abutments of the arch over the longwall (and goaves) and that of the unmined pillars in the overlying coalbed, very likely could have been a factor in the resultant bump. When the

retreating longwall passed under the isolated pillars in the upper coalbed, it follows that the arch extending downward from the isolated pillars would be superimposed upon the abutment zone of the longwall pressure arch.

A major coal bump disaster in which six men were killed occurred in the Upper Banner coalbed of the company's No. 2 Mine on May 20, 1948. The area involved in this bump, reportedly, was about 1,500 feet from the scene of the bump in the 5 left longwall area in the Tiller coalbed.

After the bump in the longwall section, 8 hydraulic pressure cells, connected in pairs to continuous Bristol recorders, were installed at 4 locations spaced 75 feet apart outby the longwall face (in the last 200 feet of the longwall panel). Instrumentation was by Bureau of Mines representatives, initiated as a continuing cooperative study with management of outburst conditions in this mine. The cells were installed in holes, 2 inches in diameter, drilled to depths of 15 and 20 feet at mid-seam height. The holes at each of the 4 test sites were spaced 2 feet apart. Primary purpose of instrumenting the remaining portion of the longwall, was to keep close observation of changes within the high pressure zone of the front abutment and its rate of movement during final mining of the longwall panel.

CAUSE OF COAL-MINE BUMP

This bump was a cumulative process from a combination of factors that altered abutment pressures ultimately causing an imposition of a shock or impact load upon a series of stressed pillars situated between superimposed abutments of the longwall area and the mined-out areas. Some of the basic environmental factors in this bump include: natural conditions conducive to bumps; pillars left to protect the longwall tail entries incapable of withstanding the superimposed shock loads (elastic rebound); longwall mining in the subjacent Tiller coalbed passed under isolated pillars left in the overlying coalbed in 1927 - 1929; flexure and separation of the overlying strata altering distribution of abutment loads that possibly caused failure of rock in the voids from weight transmission onto the longwall section from the extensively mined superjacent (Upper Banner) coalbed.

RECOMMENDATIONS

It is realized that the conditions which exist where consecutive mining of vertically adjacent coalbeds has been done are very complex and the interactions of the various factors cannot be evaluated with precision. This situation applies in many respects to longwall mining; however, the

following recommendations may minimize coal-mine bumps at this mine in the near future:

1. Chain pillars left to protect the tail entries in future longwalls should be adequate in dimensions and of sufficient strength to withstand the variable abutment pressures from the adjacent mined-out areas and of the retreating longwall.
2. The plans for future longwall mining should take into consideration the degree to which the effects of previous mining in the superjacent coalbeds will contribute to potential outbursts in the underlying coalbeds.

The following recommendations, although not directly involved in the bump are considered good mining practices and should increase the safety factors from the roof-fall and the bump aspects:

1. The mining plan for future longwalls should include barrier pillars, a minimum of 225 feet in least dimensions, for adequate protection of airways and haulageways. Mining a longwall panel its entire length, or the process of reducing the final portion of a longwall panel could induce a severe outburst in the presence of natural conditions favorable to such occurrence.
2. The roof span between the walking tail section and the adjacent tail-entry chain pillar should be supported with hydraulic-powered jacks or with at least one row of timbers on 4-foot centers.
3. During longwall retreat, the roof at the entrance to the first and second crosscuts immediately outby the tail section should be supported with not less than a minimum of 4 timbers, or equivalent support.
4. The operating safety standard requiring longwall mining operations to be stopped when unusual occurrences or reactions are observed should continue to be strictly adhered to. Fracturing of massive sandstone roof in the goaf and between the supports and the face, excessive yielding of supports, cantilevering roof extending farther into the gob than normal, floor heave in the vicinity of the longwall, and loud noises emanating from the gob usually are indications of a high stress buildup in abutment zones.

ACKNOWLEDGMENT

The cooperation of company officials and employees and the representative of the United Mine Workers of America during this investigation is gratefully acknowledged.

Respectfully submitted,

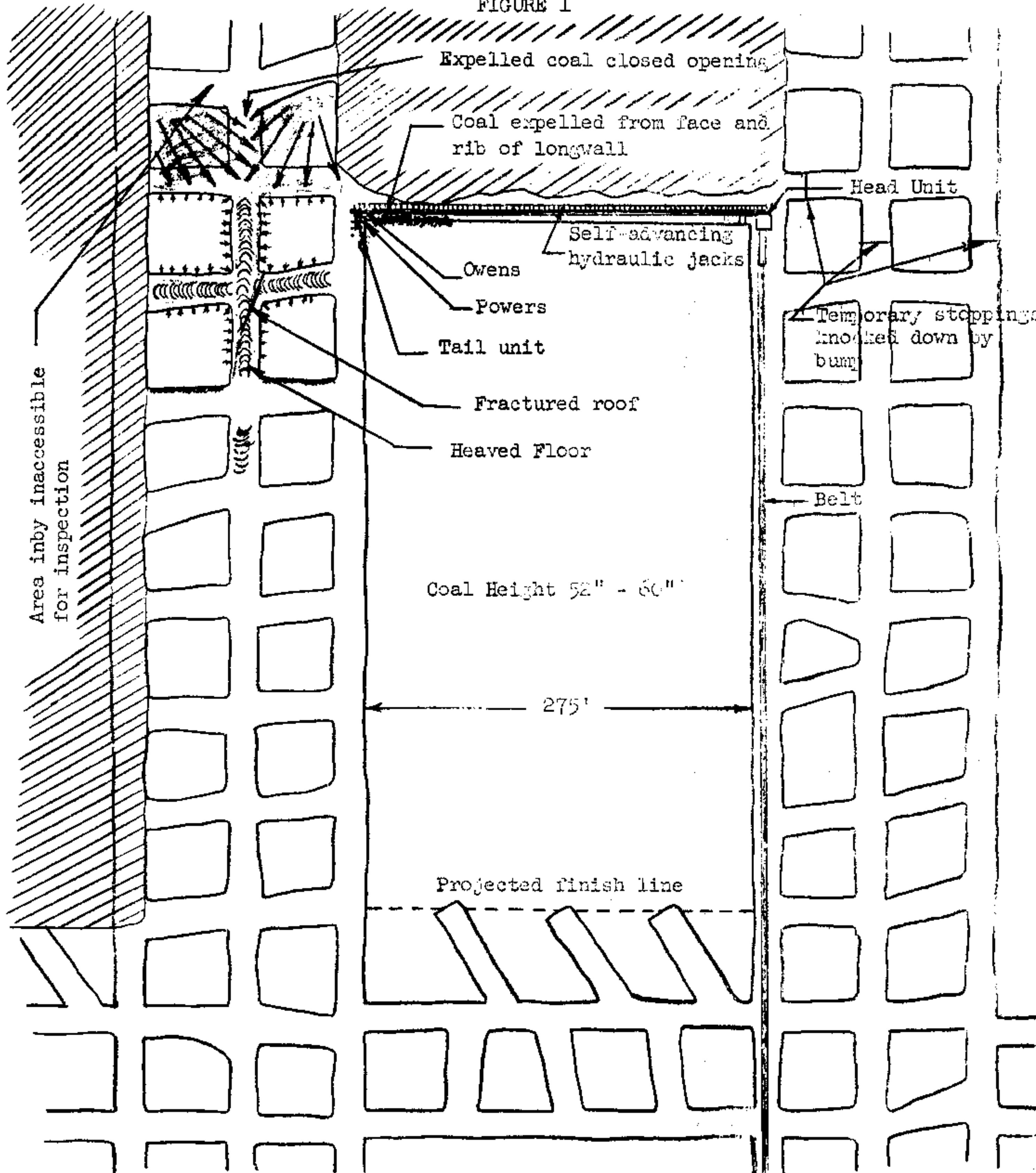
/s/ J. L. Gilley

J. L. Gilley

/s/ W. R. Compton

W. R. Compton
Mining Engineers

FIGURE 1



COAL-MINE BUMP ACCIDENT
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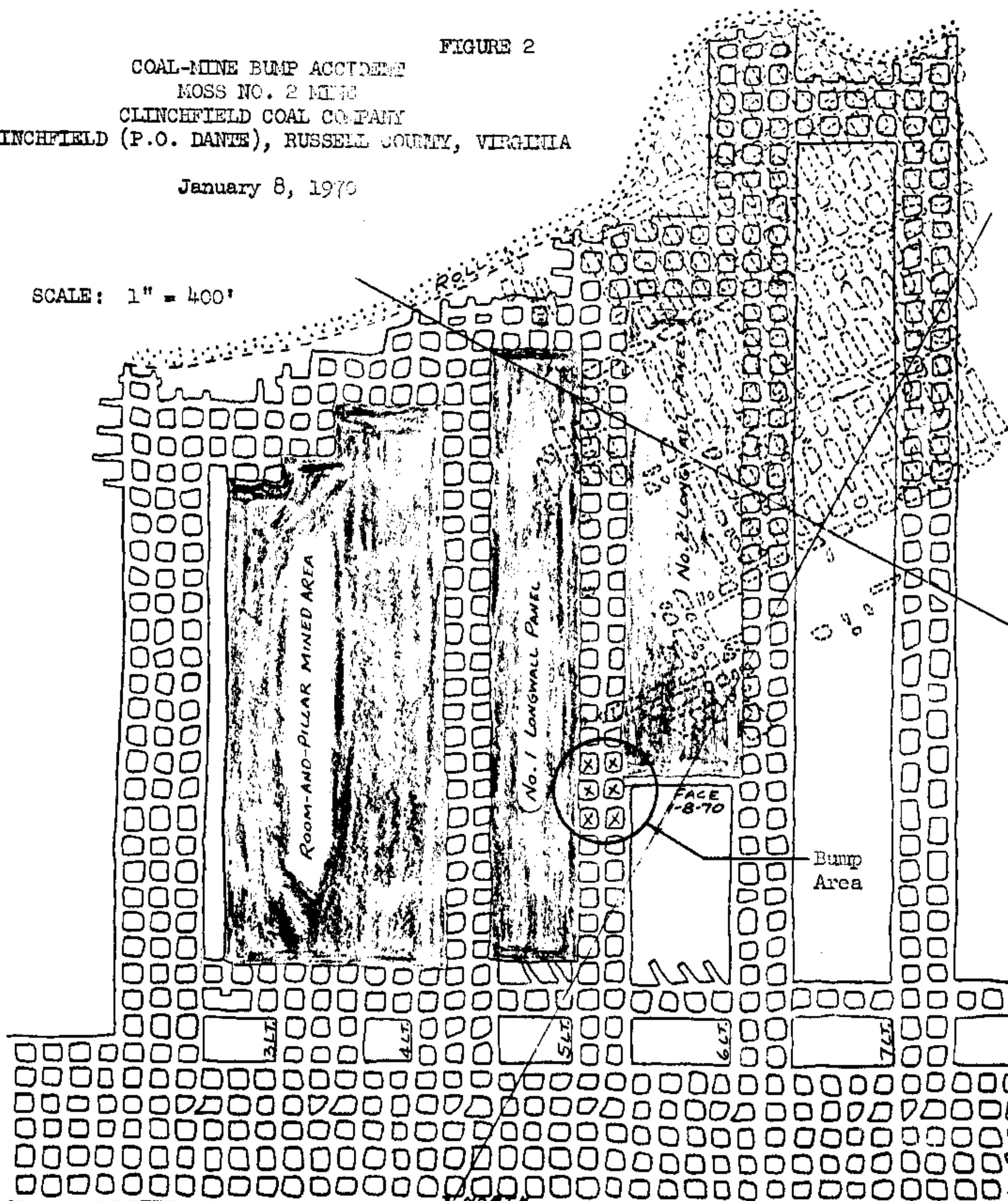
SCALE: 1" = 100'

FIGURE 2

COAL-MINE BUMP ACCIDENT
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January 8, 1970

SCALE: 1" = 400'



115' to Prospect
Hole No. 229

182' to Prospect Hole
No. 339

LEGEND:

Solid lines show mining in the Tiller Coal
Broken lines show mining in the superjace
Upper Banner Coalbed.

[illegible]







45'-7"

5'-2''

67'-3"

51'-4"

Gray Sandstone w/shale streaks
1'-6" Gray sandstone

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<p>  </p>	<p>  </p>
<p>  </p>	<p>  </p>

49'-0"

56 - 4. 11

7'-3''

47'-9"

$$\begin{array}{l} 2^1 - 3^{11} \\ 2^1 - 7^{11} \end{array}$$